



High Energy Spectroscopic Imager (HESSI)
Mission Operations Center (MOC) to
Science Operations Center (SOC)
Interface Control Document (ICD)

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Document Revision Record

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1. Introduction

During all mission phases including Mission I&T, HESSI engineering and science telemetry will be initially received and processed by the MOC Integrated Test and Operations System (ITOS) before being distributed to the SOC Archive and Real-Time Systems for science data processing. The telemetry includes stored spacecraft housekeeping (VC1), real-time science (VC2), and stored science data (VC3). ITOS will forward the VC2 telemetry in real-time to the SOC Real-Time System or save the data to a file and transfer it following a data collection period. ITOS will save the VC1 and VC2 telemetry to a file and forward it to the SOC Archive System following a data collection period. This document fully discusses the data transfer protocol, data structures, and file naming conventions involved in the transfer of data to the SOC Archive and Real-Time Systems.

1.1. *Document Conventions*

In this document, **TBD** (To Be Determined) means that no data currently exists. A value followed by **TBR** (To Be Resolved) means that this value is preliminary. In either case, the value is typically followed the initials and organization of the person responsible for providing the data, and a unique reference number. Below is a list of responsible personnel and initials.

JM – Jim McTiernan, UCB

TQ – Tim Quinn, UCB

1.2. *Applicable Documents*

The following documents are called out as references in this document to provide further detail or instruction. All ICD documents can be found on the Berkeley HESSI FTP site:

<ftp://apollo.ssl.berkeley.edu/pub/hessi/released/icd>

1. HESSI Telemetry Format, File HSI_SYS_007B
2. HESSI Command Format, File HSI_SYS_008A

The indicated version number (letter code at the end of the file name) is the official version. Later versions may appear in the Web site but are not considered official until they appear in this list.

2. System Descriptions

2.1. *MOC Integrated Test and Operations System (ITOS)*

ITOS is the primary telemetry processing and distribution component of the HESSI Ground Data System (GDS). As ITOS receives telemetry transfer frames from a telemetry source (ground station or I&T SCAT front-end) it strips out the source packets, performs quality checks, and applies a TBD-TQ-000-byte annotation header. VC1 and VC3 packets will be saved to a file and transferred to the SOC Archive system following a data collection period. As the VC2 packets are stripped out of the transfer frames they can be forwarded to the SOC workstation for immediate display, or saved to a file and transferred following a data collection period.

2.2. *SOC Archive System*

The SOC Archive System will receive the VC1 and VC3 telemetry frames from ITOS and produce level zero telemetry data, quicklook, and catalog products which will be archived on CD-R media and delivered to SDAC and HEDC. These data products will also be distributed to a on-line archive at the SOC.

When the data is received on the SOC Archive System it is managed by shell scripts similar to those used on the FAST SOC Archive System. The general process will look like:

- Ingest VC1/VC3 data contact data file
- Reorganize contact file into smaller orbit files (Level Zero Files)
- Perform Quick-look/catalog generation
- Calculate clock offset and attach clock offset file to data
- Archive Level Zero files and Quick-look/catalog on CD-R media
- Distribute CD-R media and make data available on-line at UCB

The SOC archive software will include:

- UNIX shell scripts: used to move data around, call programs, log status information
- Telemetry_2_level0: IDL routine for converting telemetry packets to Level 0 and quick look data
- Auto_quick_look: IDL routine for performing quick look and catalog generation

- Clock_Delta = C-program which calculates single time for spacecraft clock drift and places time in file attached to data session files. The clock drift used by data analysis software.
- CD-R production software
- Data Access software (IDL Routines)

2.3. ***SOC Real-Time System***

Real-time science telemetry (VC2) will be passed from ITOS to the SOC Real-Time System for display and then discarded. VC2 is a subset of the stored science data (VC3). Access to the latest science data is required during testing, flare events, and to quickly assess on-orbit changes to the instrument configuration. The same data analysis routines running on the SOC Archive System will reside on the SOC Real-Time System and will be used to process the VC2 data.

3. System Requirements

3.1. *MOC Integrated Test and Operations System (ITOS)*

ITOS is a GOTS product running on SUN Ultra 5 or 10 machine, 128 megabytes RAM, Solaris 2.6, and MOTIF 2.0. All connections to the SOC systems will be made through the HESSI isolated network.

3.2. *SOC Archive System*

SOC archive software will run on a SUN Ultra 5 or 10 machine, Solaris 2.6, MOTIF 2.0.

3.3. *SOC Real-Time System*

SOC real-time data analysis software will run on a SUN Ultra 5 or 10 machine, Solaris 2.6, MOTIF 2.0.

4. Products and Formats

4.1. *MOC ITOS*

4.1.1. SOC Real-Time System

4.1.1.1 VC2 Telemetry Packets

Description

During Mission I&T, L&EO instrument checkout, and normal operations real-time science (VC2) will be dumped from the spacecraft recorder. ITOS will receive VC2 transfer frames, extract the source packets, perform quality checks, and append each packet with a TBD-TQ-000-byte annotation header. Following this, two options are available for transferring the data to the SOC REAL-TIME workstation:

-Forward annotated VC2 packets in real-time via a TCP/IP or UDP socket connection

-Save annotated VC2 packets to a file and forward following the data collection period. The file naming will take the form vc_yyyymmddhhmmss, where the given time is the time of data collection initiation.

The real-time and post-pass sequences are represented in figures 1 and 2.

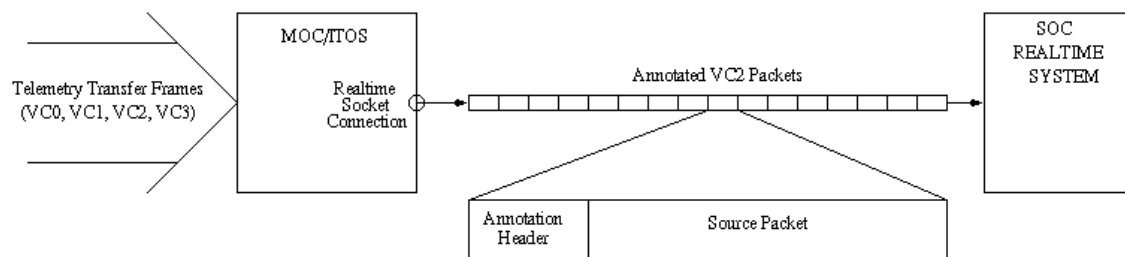


FIGURE 1. Real-Time VC2 Packet Transfer from MOC to SOC REAL-TIME Workstation

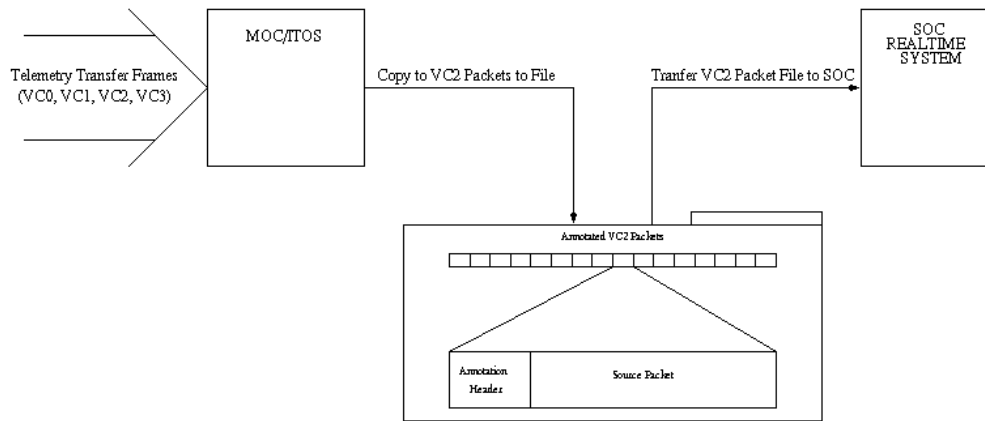


FIGURE 2. Post-Pass VC2 Packet Transfer from MOC to SOC REAL-TIME Workstation

Support Duration

Support is required during all mission phases.

Format

For the VC2 source packet format, reference the HESSI Telemetry Formats document HSI_SYS_007B. The order and complete content of the annotation header are TBD-TQ-000, but will most likely contain the following:

- 1) CCSDS transfer frame version
- 2) Spacecraft ID
- 3) Virtual Channel ID
- 4) Ground station received time (if available)
- 5) The following flag bits:
 - packet header error
 - bits reversed
 - packet sequence error
 - transfer frame error
 - frame error check enabled
 - incomplete packet
 - VC sequence error
 - transfer frame header error
- 6) Offset to fill data (for incomplete packets)

If a packet file is transferred, it will use the following naming convention:

VC2 Filename -> vc_yyyymmddhhmmss

Where:

yyyy = year

mm = 2 digit month, 01 - 12

dd = 2 digit day of month, 01 - 31

hh = 2 digit hour of day, 00 - 23

mm = 2 digit minute of day, 00 - 59

ss = 2 digit second of day, 00 - 59

Accuracy and Completeness

100% - Accuracy and completeness will be monitored at the TCP/IP level.

Timespan

The duration of VC 2 telemetry dumped by the spacecraft is commandable to the latest N seconds of data.

Volume Estimate

The VC2 packet volume will range from **TBD-TQ-001**.

Delivery Schedule

VC 2 telemetry will be dumped during I&T tests, L&EO instrument checkout, and as needed during normal operations.

Medium

For the real-time transfer, either ITOS or the SOC Real-Time System will initiate a real-time TCP/IP or UDP socket connection (exact protocol TBD-TQ-002) over the HESSI Isolated Network. Either a ITOS or SOC Real-Time procedure can be set to initiate a socket connection for the duration of the ground station contact. The initiation can also be controlled by the **Gateway Daemon (reference?)**. The post-pass transfer will involve a remote copy from the ITOS workstation to the SOC REAL-TIME machine over the HESSI Isolated Network.

4.1.2. SOC Archive System

4.1.2.1 VC1/VC3 Telemetry Packets

Description

As ITOS receives the VC1 and VC3 transfer frames it will extract the source packets. The source packets will be quality checked and appended with a TBD-TQ-000-byte annotation header. The annotated VC1 and VC3 packets collected during a contact will be placed in a single file with the naming convention `vc_yyyymmddhhmmss` where the given time refers to the data collection initiation. When packet collection is complete, ITOS will copy the file to the SOC Archive System. This sequence is illustrated in figure 3.

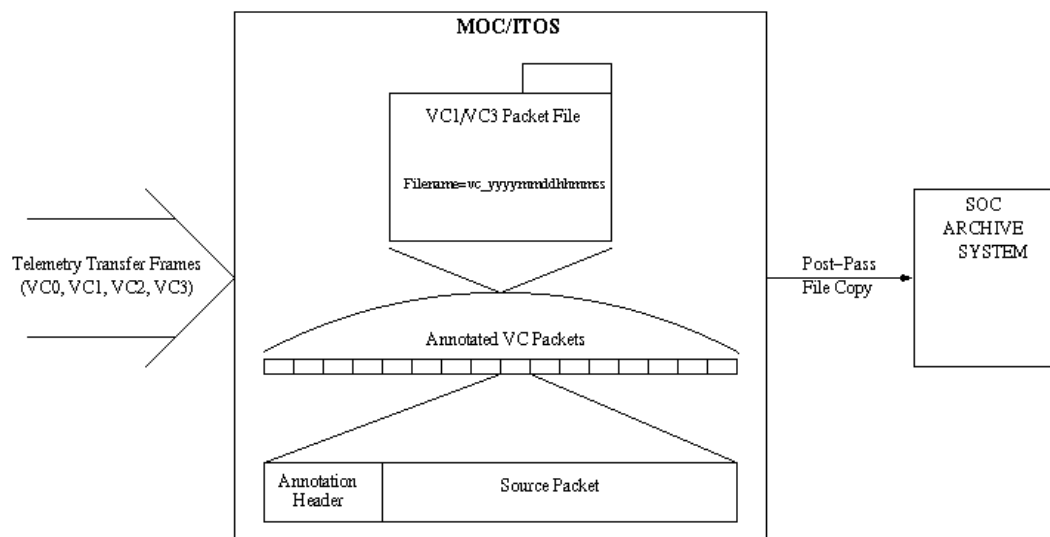


FIGURE 3. VC1/VC3 Packet File Transfer from MOC to SOC Archive System

Support Duration

Support is required during all mission phases.

Format

The file format will be the same as that described for the real-time packets (annotation header + source packet). The files will have the following naming convention:

VC1/VC3 Filename -> vc_yyyymmddhhmmss

Where:

yyyy = year

mm = 2 digit month, 01 - 12

dd = 2 digit day of month, 01 - 31

hh = 2 digit hour of day, 00 - 23

mm = 2 digit minute of day, 00 - 59

ss = 2 digit second of day, 00 - 59

Accuracy and Completeness

100% - Accuracy and completeness will be monitored at the TCP/IP level.

Timespan

The duration of VC 1 and 3 telemetry dumped by the spacecraft is commandable, but will usually be no longer than the expected Berkeley contact lengths of 10 minutes.

Volume Estimate

Based on a 10 minute contact at the Berkeley Ground Station and a bit rate of 4 Mbps, the VC1/VC3 packet file size could reach 300 Mbytes.

Delivery Schedule

VC 1 and 3 telemetry will be dumped during every ground station contact.

Medium

ITOS will copy (or FTP) the data file to the SOC Archive System. The copy process will initiate processing of the data files on the SOC Archive System.